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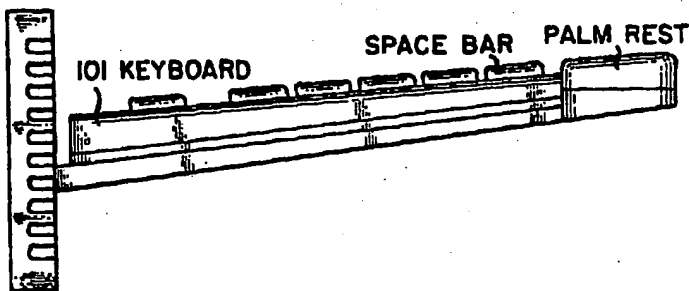
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(21) International Application Number: <b>PCT/US95/02012</b> (22) International Filing Date: <b>15 February 1995 (15.02.95)</b> (30) Priority Data: <b>08/198,890</b> <b>18 February 1994 (18.02.94)</b> <b>US</b>  (71)(72) Applicant and Inventor: <b>MARTIN, Michael [US/US];</b> <b>Unit 8, 50 Tannery Road, Branchburg, NJ 08876 (US).</b>  (74) Agent: <b>FRAYNE, Clifford, G.; 44 Princeton Avenue, Brick</b> <b>Town, NJ 08724 (US).</b>		(81) Designated States: <b>CA, JP, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</b>  <b>Published</b> <i>With international search report.</i>

(54) Title: **IMPROVED ADJUSTABLE ERGONOMIC SUPPORT FOR COMPUTER KEYBOARDS**

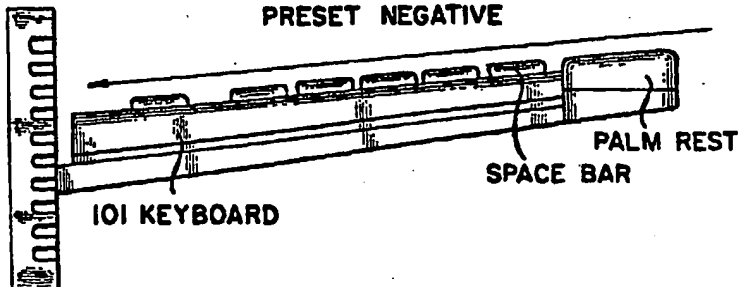
(57) Abstract

A keyboard positioning system (10), either alone or in combination with other computer aids, which is ergonomic in design and allows for height adjustments to accommodate operators of different anatomical sizes, yet presets the angle of palm rest (22) and angle of keyboard tray (12) to a wrist neutral position to ensure the proper positioning of the operator's hands, wrist and fingers to greatly lessen or eliminate stress and strain injuries.

**FRONT  
RATCHET  
HEIGHT  
ADJUSTMENT**



**PRESET NEGATIVE**



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IMPROVED ADJUSTABLE ERGONOMIC SUPPORT FOR  
COMPUTER KEYBOARDS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an improved adjustable support platform for support of a computer keyboard, the support being fully adjustable in height for individuals of varying sizes, either right-handed or left-handed, the support having a preset angle with respect to the palm rest and keyboard tray to ensure support of a neutral wrist angle and neutral finger angle position.

The advent of the personal computer in the early 1980's resulted in a total revamping and change in the office environment. Data processing and word processing could now be accomplished at much greater speeds and efficiencies. The keyboard developed for use with personal computers evolve from the technology associated with manual typewriters which required a posture suited to a slower typing rate and heavy downward stroke on the keys. Further, the manual machines and even the later generation electric typewriters provided for frequent rest periods for the operator. Fingers could rest on the keys without causing them to actuate and rests were further provided by interruptions, such as carriage returns, paper changes and manual error corrections. These short rests or mini breaks allow time for recovery from any fatigue, trauma or tension of the lower arms, wrist and fingers.

With the advent of the personal computer, office place injuries in the form of carpal tunnel syndrome have

more than doubled. This trauma occurs when the nerve and tissues in the carpal tunnel within the wrist are compressed by the bones and ligaments. It results in numbness, tingling and pain in the hand and fingers that migrates to the elbow and shoulders. Corrective surgery to correct this malady is required in over 50% of the cases and in some instances, must be repeated a second time within 18 months.

~~One culprit identified~~ in the rise of carpal tunnel syndrome is the computer keyboard and its positioning vis-a-vis the posture of the operator. The computer and the associated keyboard have eliminated the mini or micro breaks that the operator experienced in using manual machines or late model electric typewriters. There is no longer a carriage return. Paper changes are not required and manual error corrections are performed through further use of the keyboard. Feather-touch keys on the keyboards reduce the amount of force required to actuate the keys and mandate that the operator cannot rest their fingers on the keys. Productivity is increased dramatically as a result of the development of the personal computer. Typing speeds in the form of strokes per hour have quadrupled since all corrections and directions are now performed by keyboard functions with directions to the personal computer. However, the overall method of data entry has not significantly improved. Computer operators continue to assume the traditional typing position in which the wrists are flexed. This position is acceptable for manual typewriters where the mini breaks occur in the data entry

process, but is not suitable for utilizing computer keyboards for data entry where the speed of data entry has been greatly increased.

There have been many attempts to develop a keyboard support which would combine several advantages for the keyboard operator. These developments include mounts which allow the keyboard support to be slipped under the desktop, supports which allow the raising and lowering of the keyboard, and in some instances, attempts have been made to provide for the tilting of the keyboard. Examples of these developments can be found in the following U.S. patents: 5,037,054; 5,040,760; 5,031,867; 4,982,066; 4,913,390; 4,826,123; 4,776,284; 4,706,919; 4,691,888; 4,635,893; and 4,616,798. None of the above patents address the key issues with respect to the positional relationship of the keyboard in both horizontal and vertical planes through the relationship of the positioning of the operator's forearms, wrists and fingers.

Applicant, in his prior application, Serial No. 07/871,108, addresses an ergonomically-designed support for the keyboard and other related computer aids including document holders in which the position of the operator's forearms, wrists and fingers were maintained in a neutral position with the keyboard support in a slightly tilted, non-horizontal plane, the rear of the keyboard being slightly lower than the front of the keyboard thereby eliminating any flexation or extension of the forearms, wrists and fingers of the operator.

This application addresses the same problems, however, Applicant has further improved the keyboard to preset the angle of the palm rest and to preset the angle of the keyboard tray to cover a wide range of anthropometric hand and finger sizes to ensure that the angle of the palm rest and keyboard tray remain in a neutral position vis-a-vis the operator. Active height adjustment would be available to accommodate the physical parameters of the individual using the keyboard and an active fine adjustment mechanism would be available to accommodate extreme variations and diversities in the anthropometric range.

The ability to preset the angle of palm rest and keyboard tray, yet allow height adjustment and the angles of fine adjustment is accomplished through a novel adjustment means cooperative between the keyboard tray, and the support means securing the keyboard tray to the desk or computer stand.

#### OBJECT OF THE INVENTION

An object of the present invention is to provide for a novel computer keyboard support with preset keyboard and palm rest angles to ensure maintenance of a neutral wrist position by the operator.

Another object of the present invention is to provide for a novel keyboard support that permits height adjustments to accommodate individuals of varying physical parameters.

A further object of the present invention is to provide for a novel keyboard support in which the preset

keyboard and palm rest angles and broad enough to cover a wide range of anthropometric parameters.

A still further object of the present invention is to provide for a novel keyboard support in which a fine adjustment is available in order to accommodate extreme variations and diversities in anthropometric range.

#### SUMMARY OF THE INVENTION

The present invention is directed towards a keyboard positioning system, either alone or in combination with other computer aids, such as a document holder, mouse pad and writing surface which is ergonomic in design and allows for height adjustments to accommodate operators of different anatomical sizes, yet presets the angle of palm rest and the angle of keyboard tray to a neutral position to ensure that the operator's wrist and fingers remain in a neutral position when operating the system thereby greatly lessening or eliminating the possibility of the development of carpal tunnel syndrome. The keyboard positioning system would preset the angle of palm rest and the angle of keyboard to cover the broadest anthropometric range, yet would still allow for the fine adjustment in order to accommodate extreme variations in the anthropometric range, the keyboard support and support means cooperable to ensure the maintenance of the neutral position even when the keyboard tray is adjusted for varying heights.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The objects of the invention, together with other advantages will become apparent, particularly when taken in light of the following drawings wherein:

Figure 1 is an exploded side view of the keyboard support illustrating the three primary components.

Figure 2 is a side elevational view of the keyboard support.

Figure 3 is a rear elevational view of the keyboard support.

Figure 4 is a front elevational view of the height adjustment member.

Figure 5 is a side view of the height adjustment member.

Figure 6 is a front view showing the cooperation between the keyboard support and the height adjustment member.

Figure 7 is a side view of the mounting support.

Figure 8 is a rear view of the mounting support.

Figure 9 is a top view of the mounting support.

Figure 10 is a side view illustrating the neutral wrist position preset in the keyboard support in order to avoid fatigue, tension and pain.

#### DETAILED DESCRIPTION OF THE DRAWINGS

The adjustable ergonomic keyboard support 10 is comprised of three (3) primary elements; the keyboard support 12, the height adjustment member 14, and the mounting member 16. These three elements are illustrated in Figure 1 which is a side elevational exploded view of keyboard support 10.

As illustrated in Figure 1 and Figure 2 which is a side elevational view of keyboard support 12, the keyboard support consists of a planar support base 18 which



generally subscribes to the shape and dimensions of a standard computer keyboard. Base 18 has formed on its first end 20, a palm and a wrist support 22. Palm and wrist support 22 is designed to support the wrist and palm of the operator in the preferred neutral position as discussed in detail hereafter. Palm support 22 is configured to the correct height in order to provide the neutral support for the operator when the computer keyboard is positioned on base 18 and its longitudinal edge is in proximate contact with the palm support 22.

Keyboard support 12 has two upstanding parallel bracket supports 24 positioned equidistance from ends 26 and 28 of keyboard support 10. Brackets 24 are best illustrated with respect to Figure 3 which is a rear view of keyboard support 12. Brackets 23 are designed for cooperation with height adjustment member 14. Brackets 24 have positioned therebetween, a positioning rod 30 which is cooperable with a mounting slot formed on height adjustment member 14 as discussed hereafter.

There is further positioned on the rearward side of keyboard support 12, a pair of horizontal locking means 32. These locking means 32 are in the form of horizontally-formed protrusions on the rear face of keyboard support 12 and are cooperable with complimentary detents in height adjustment member 14 as described hereafter. In addition to locking protrusions 32, the rear face of keyboard support 12 has a locking cross arm 34 cooperable with a selective switch element 36 on the front side of the rear face of keyboard support 12. Switch 36 in

cooperation with locking cross member 34 and locking protrusions 32 secure the keyboard support member 12 in the desired height position in relationship to the height adjustment member 14.

A front view of height adjustment member 14 is illustrated in Figure 4. Height adjustment member 14 is comprised of two (2) end brackets 40 and 42 and a forward face 44 which is cooperable with the rear face of keyboard support 12. Height adjustment member 14 is generally rectangular in shape having a vertical slot 46 centrally positioned thereon, which vertical slot accommodates locking cross member 34 of keyboard support 12 in a slidable manner.

The front face of height adjustment means 14 has a plurality of perpendicularly aligned vertical detents 48 which in turn are cooperable with locking elements 32 on the rear face of keyboard support 12.

Additionally, height adjustment member 14 has a second set of vertically-disposed perpendicular indents 50 positioned inwardly and adjacent to brackets 40 and 42. These detents cooperate with complimentary locking elements 52 formed on the upper rearward portions of brackets 24 of keyboard support 12.

In operation, swivel latch 36 is operable from an opened position to a fully locked position. In the opened position, keyboard support 12 may be adjusted upwardly or downwardly in relationship to height adjustment member 14 by means of guide rod 30. This is accomplished by pulling keyboard support tray outwardly and upwardly in

relationship to height adjustment member 14. Keyboard support tray 12 is then slidably moved upwardly or downwardly to obtain the desired height. It is then rotated downwardly such that locking elements 32 on its rearward face engage complimentary detdents 48 on the front face of height adjustment member 14. Simultaneously, locking protrusions 52 on brackets 24 of keyboard support 12 would engage complimentary detentss 50 on height adjustment member 14. ~~Swivel latch 36~~ would then be moved from the opened to the locked position. This in turn would rotate locking cross member 34 from a vertical position; the position it is found when in the opened position, to a horizontal or locked position in which it causes compression upon the height adjustment member thereby locking the keyboard support in relationship to the height adjustment member. This relationship may best be illustrated in Figure 6 which is a front view of keyboard support 12 in cooperation with height adjustment member 14 showing the manner in which keyboard support 12 is ratchetly engaged with height adjustment member 14. In Figure 6, selector switch 36 is positioned in the opened position which would allow for the upward or downward movement of keyboard support 12. Once the correct height had been obtained, the selector switch 36 would be moved approximately 180° to the locked position which in turn would cause cross member 34 to rotate into locking engagement vis-a-vis slot 46, with height adjustment member 14.

Height adjustment member 14 is cooperable with the third element of the keyboard support apparatus, namely, the horizontal mounting member 16. As illustrated in Figure 1 and Figure 5, a side view of height adjustment member 14, each of the parallel side bracket members 40 and 42 have extending rearwardly therefrom, an upstanding arcuate member 54 in parallel relationship with each other, each member 54 having an arcuate slot 56 formed therein, slots 56 being in parallel relationship to each other.

Figure 7, 8 and 9 are respectively, a side view, rear view and top view of horizontal mounting member 16. Horizontal mounting member 16 has a generally planar upper surface 60 for cooperation with the underside of the computer stand or computer table. It may be either mounted directly to the table or cooperable with a tracking system allowing for its slidable engagement under the table. At its interior end 62, horizontal mounting member 16 may have a plurality of cutouts 64 for the securing of the mounting member to the underside of the computer table or stand. Alternatively, lateral edges 66 could serve to position the horizontal mounting member 16 within a tracking system on the underside of the computer table.

Exterior end 68 has two parallel protruding swivel points 70 for cooperation with swivel point 72 positioned in height adjustment member 14 to allow for the rotation of height adjustment member 14 about swivel point 72. These swivel points are cooperative and maintained by means of a guide rod passing therethrough.

A locking means for securing the swivel relationship between height adjustment member 14 and horizontal mounting member 16 is a compression locking member 76 positioned between downwardly-depending flanges 78 of horizontal mounting member 16. A compression locking swivel 76 in cooperation with a throughbore 80 in the rear surface of horizontal mounting member 16 in cooperation with a guide rod, cooperable with arcuate slots 56 in upstanding arcuate member 54 of height adjustment member 14 allows, for the selective angular positioning of the height adjustment member vis-a-vis horizontal mounting member. This is a fine adjustment means designed for fine tuning the positioning of the keyboard support 12 and keyboard support position thereon vis-a-vis the operator. This is an active adjustment which is designed to accommodate those extremes and variations in the anthropometric range.

Popliteal Height:	5th % Female 360mm(14.2")	95th% Male 485mm(19.5")	Variance 135mm(5")	Proformix Height Adj. 135mm(5")
Elbow to Finger:	5th % Female 400mm(15.7")	95th % Male 515mm(20.3")	Variance 115mm(4.5")	Proformix Adjustment > 115mm(4.5")
Hand Length:	5th % Female 165mm(6.5")	95th % Male 210mm(8.25")	Variance 55mm(1.75")	Proformix Palm Rest 80mm(3.13")

Figure 10 illustrates the present negative angle of the keyboard in order to avoid stress and strain. Keyboard support 12 is cooperative with height adjustment member 14 in a ratchet arrangement in order to selectively adjust the height. Another feature of the keyboard support 12, in order to further reduce stress, strain and tension on the fingers, wrist and forearms, is the non-skid, friction support pad 13 positioned on upper surface 18 of keyboard support 12. The keyboard support tray would come with several non-skid friction support pads 13 of various thicknesses. The operator would choose the non-skid pad 13 of such thickness to ensure that the upper surface of the keyboard keys would be in alignment with palm rest 22. In this configuration, the upper surface of the keys would be on the same plane and at the same height as the palm rest.

The operator can reference a laminated instructional card which details the adjustments available to the operator. This laminated card is slidably cooperable with mounting members 16 so as to be recessed under the computer stand or work surface when not in use, but slidably removable by the operator in order to reference correct settings.

The ergonomic keyboard support 10 when properly installed and adjusted provides a work area in which the operator is seated with the feet firmly on the floor and slightly ahead of the knees. This leg position facilitates the unrestricted blood circulation in the legs with the feet supporting the weight of the lower legs. The chair

height is adjusted to make the thighs nearly parallel to the floor as possible. This again avoids pressure behind the knees and promotes good blood circulation through the legs.

The operator would sit rearwardly in the chair, tilted slightly from 90° vertical and well supported in the lumbar region thereby opening the body angle at the hip. This angle reduces disk pressure and relieves the muscles of the back from holding the body perfectly upright, a position that cannot be maintained for long periods of time.

The head would be balanced, the shoulders relaxed and the arms hanging naturally so that the hands rest comfortably on the lap. This creates an open angle at the elbow joint, again providing for proper circulation.

This seated posture allows for the ergonomic keyboard support 10 to actually bring the work surface to the operator. It positions the keyboard lower, close to the lap where the arms can hang naturally with open angles at the elbow. The ergonomic keyboard support 10 supports the weight of the arms and keeps the wrists and hands straight and relaxed in what is referred to as a "wrist neutral position". This is accomplished by the negative angle of the keyboard support which slopes away from the user. The preset negative slope only permits the hands to fall naturally into the wrist neutral position.

The palm rest supports the fleshy portion of the hand and palm and presents a surface which allows the

hands to glide freely from one end of the keyboard to the other without sticking.

The ergonomic keyboard support, which is the subject matter of this application, provides the operator with a comfortable working environment in which proper posture is promoted and in which the hands, wrist and arms of the operator are properly supported and positioned to avoid stress and strain. The ergonomic keyboard support adjusts in order to bring the work, in the form of the keyboard, to the operator while the operator maintains the proper posture. While the ergonomic keyboard support of the present application allows for certain adjustments to accommodate anatomical differences between operators, certain adjustments are preset, such as the negative slope of the keyboard support, so that a wrist neutral position is maintained. This negative slope is maintained regardless of the height adjustments which are necessary for the anatomical difference of the operator.

While the present invention has been described in connection with the exemplary embodiment thereof, it will be understood that many modifications will be apparent to those of ordinary skill in the art; and that this application is intended to cover any adaptations or variations thereof. Therefore, it is manifestly intended that this invention be only limited by the claims and the equivalents thereof.



## WHAT IS CLAIMED:

1. An adjustable, ergonomically-designed support assembly for support of a keyboard of the type associated with computers, the assembly comprising in combination:

a securing means engageable with a desk or counter top;

a support bracket attached to said securing means, said support bracket comprising a fixed member depending from said securing means and a movable member secured to said fixed member and angularly positionable with said fixed member;

an angular adjusted means cooperative with said fixed member and said movable member to selectively fix the angular relationship between said fixed member and said movable member;

a platform means secured to said movable member and selectively adjustable in height, relative to said movable member;

a palm rest support formed on said platform means, said platform means and said palm rest support having a preset angular slope from the horizontal, angled downwardly and away from the operator, said platform means having a height adjustment means for positioning said keyboard in relationship to said palm rest support for positioning the upper surface of the keys of said keyboard at the same height of said palm rest support.

2. The keyboard support assembly in accordance with Claim 1 wherein the height adjustment means associated with said platform means comprises nonskid pads of selective

thickness, cooperative with the base of said platform means and with keyboards of varying shapes and sizes to adjust the height of said keyboard on said platform means so as to position said upper surface of said keys in planar alignment with said upper surface of said palm rest support.

3. The key support assembly in accordance with Claim 1 wherein said adjustable, vertical relationship between said platform means and said support bracket comprises a ratchet-like arrangement wherein protrusions on said movable member of said support bracket are alignable and cooperable with a plurality of depressions in said fixed member of said support bracket to selectively adjust the height of said movable member and said platform means secured to said movable member.

4. The keyboard support assembly in accordance with Claim 1 wherein said fixed member of said support bracket and said movable member of said support bracket cooperate to define a receptacle slot for slidable receipt of a posture guide and an instructional guide to ensure the proper adjustment of said support assembly.

5. The keyboard support assembly in accordance with Claim 1 wherein said preset angular slope from the horizontal of said platform means and said palm rest is unaffected by adjustments in height of said movable member of said support bracket.

6. A keyboard support of the type associated with and used with computer keyboards, said keyboard support comprising:

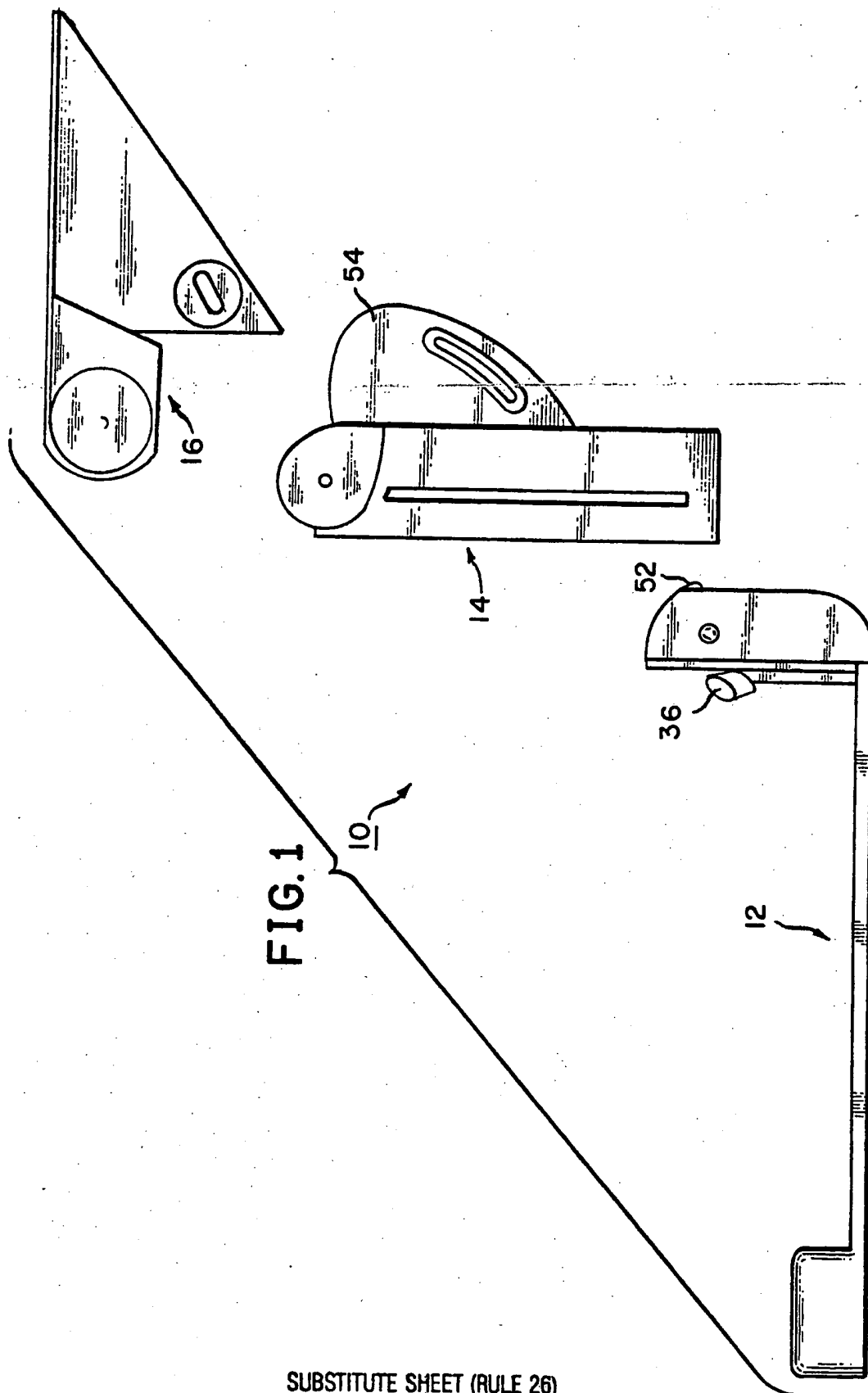
a platform, generally rectangular in nature having a front edge, and a rear edge, said platform having a preset angular slope from the horizontal sloping downwardly from said front edge to said rear edge, said platform dimensions to accommodate a computer keyboard;

a height adjustment means cooperative with said platform, said height adjustment means comprising a plurality of non-skid pads of selective thickness, cooperative with the base of said platform to adjust the height of said computer keyboards relative to said keyboard supports;

a palm rest support formed on said front edge of said platform, said palm rest support having an identical preset angular slope from the horizontal, angled downwardly and away from said front edge of said platform, said palm rest support and said height adjustment means cooperative to adjust the upper surface of the keys of said computer keyboard to the same height and preset angular slope of said palm rest support;

a means for adjusting the height of said keyboard support without interfering with said preset negative angular slope.

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FIG. 2

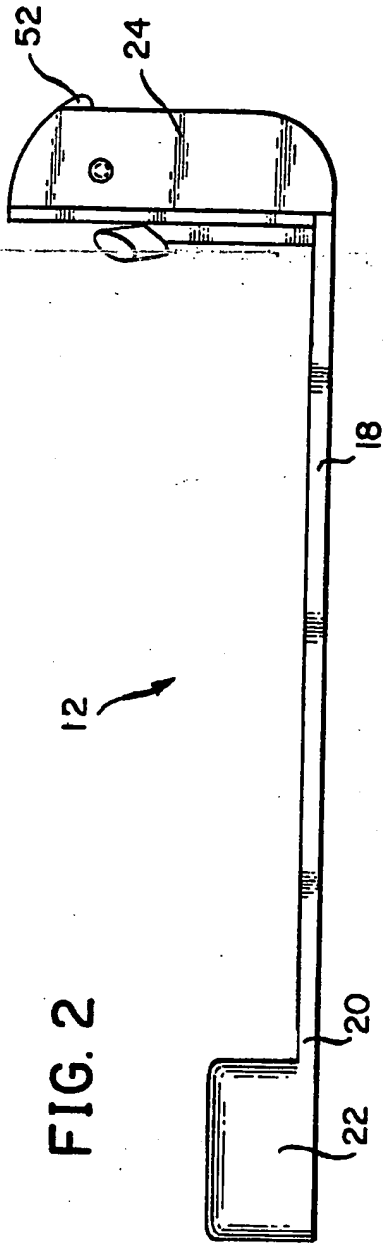


FIG. 3

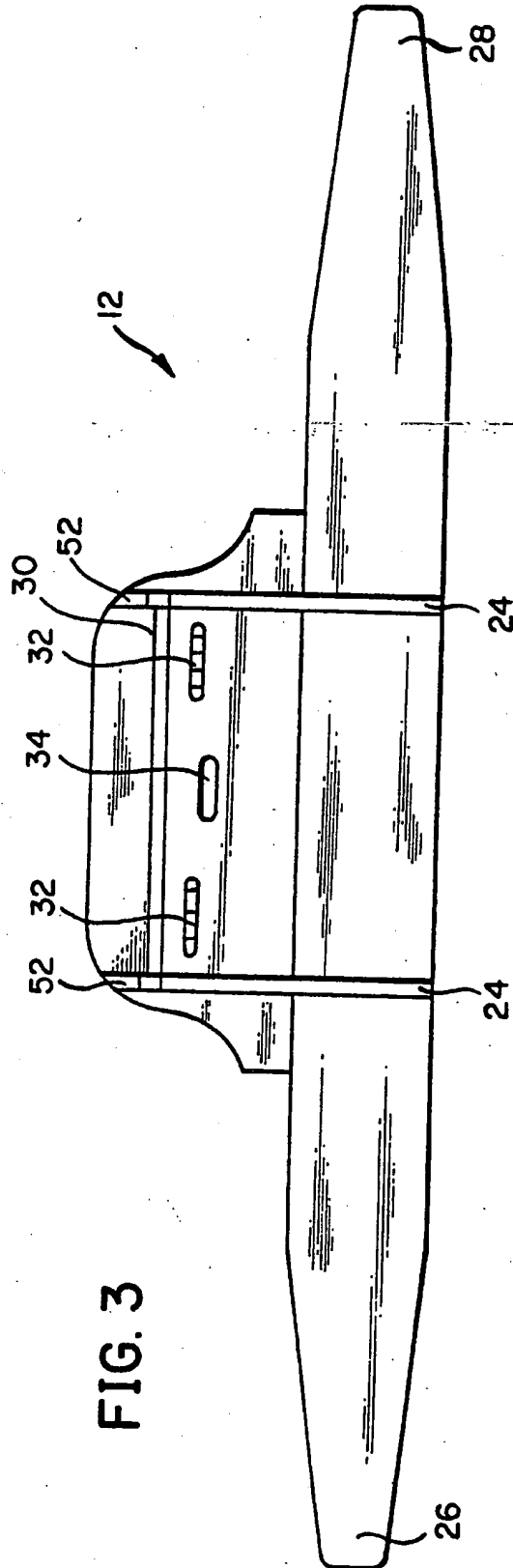


FIG. 4

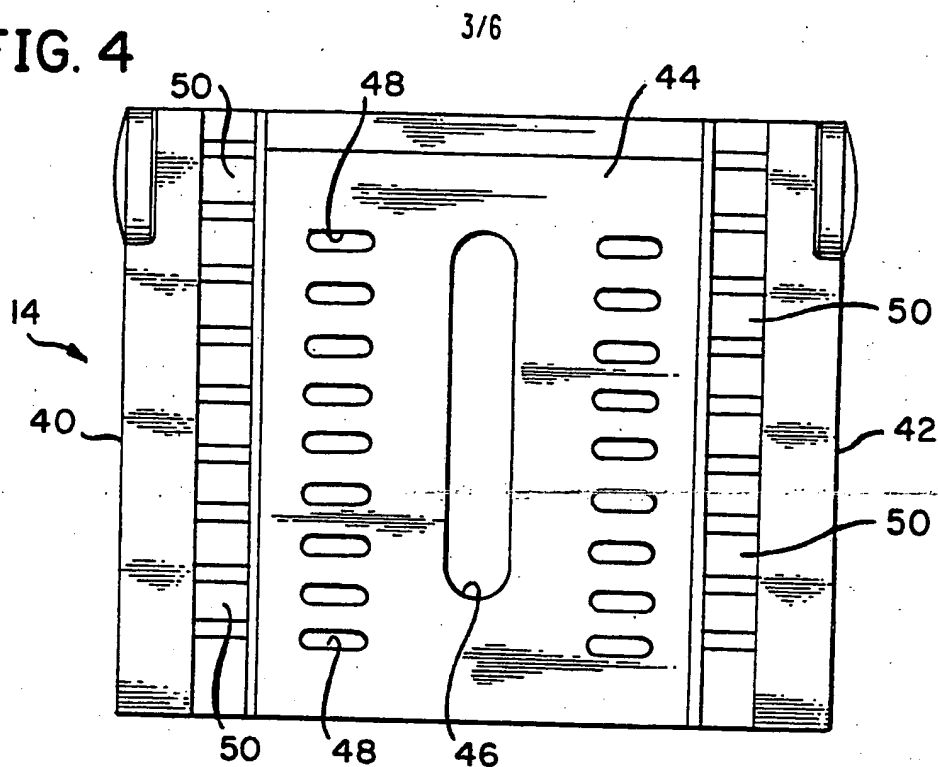


FIG. 5

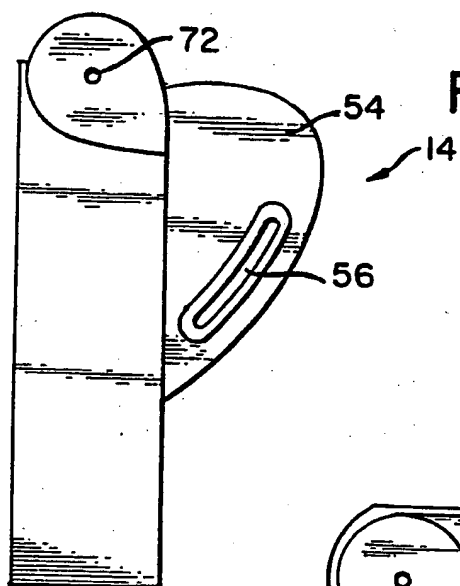


FIG. 7

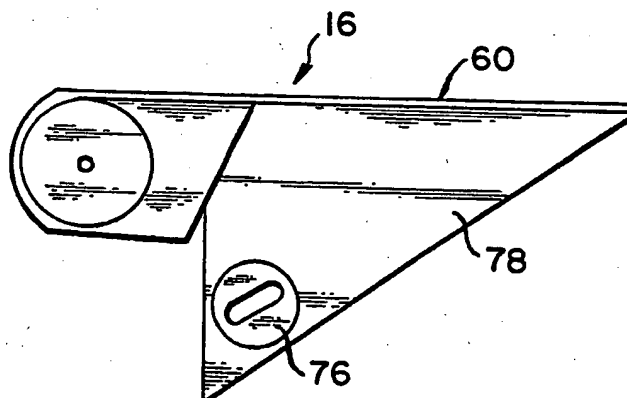
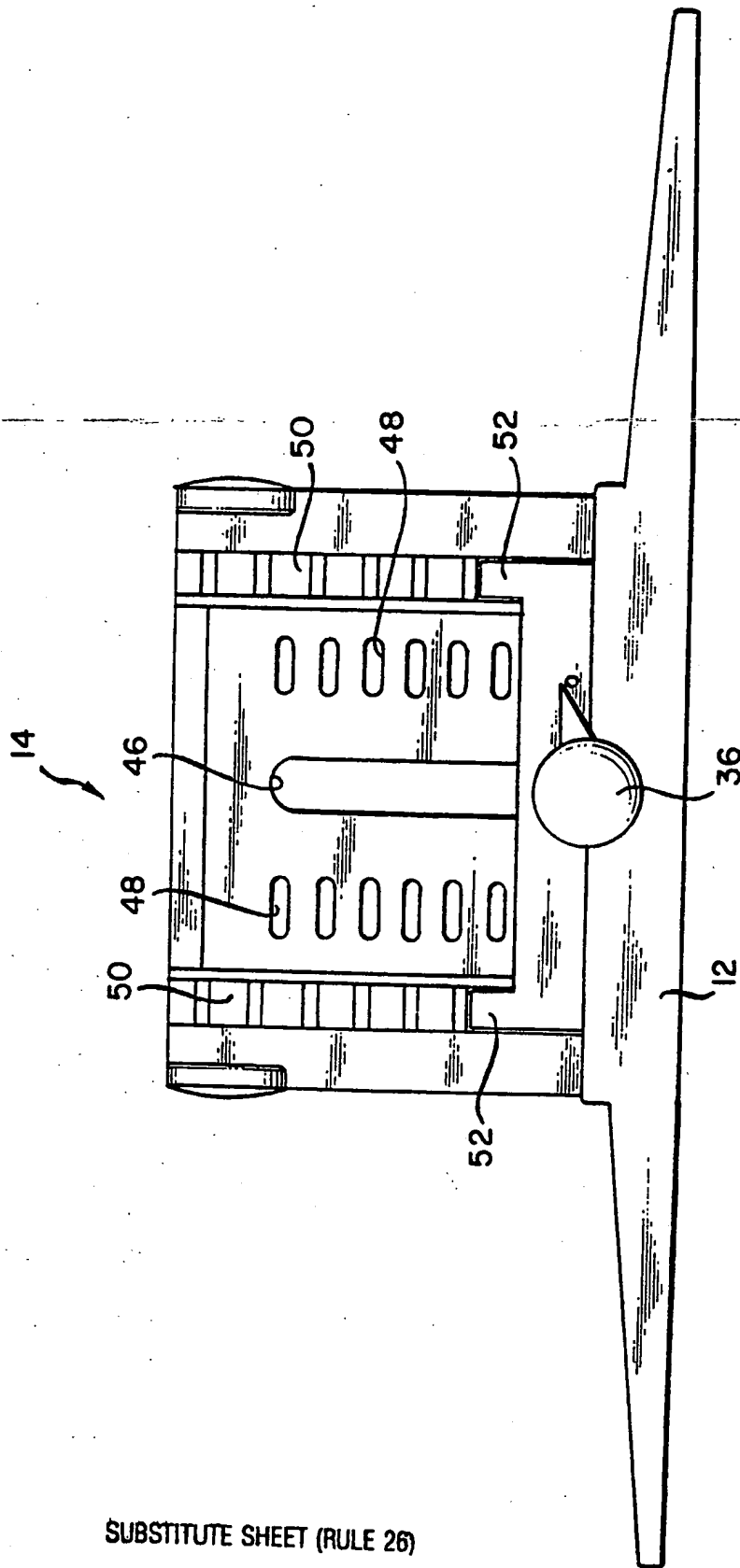
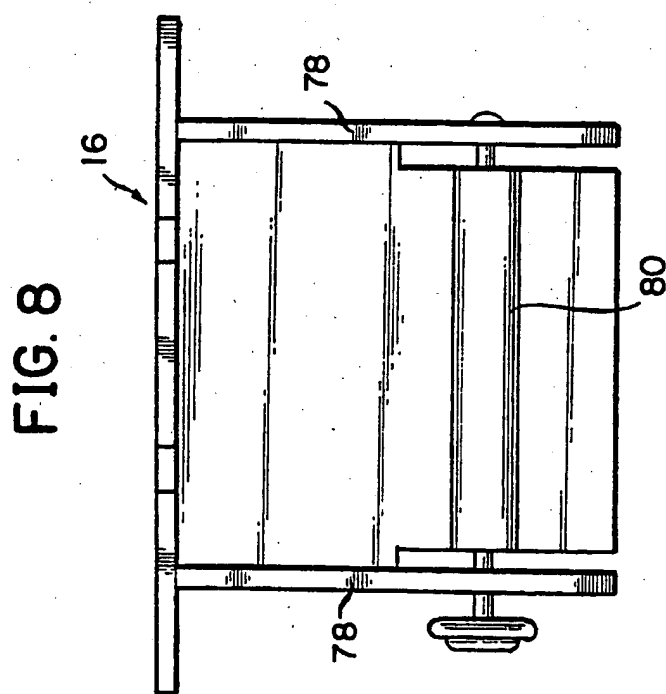
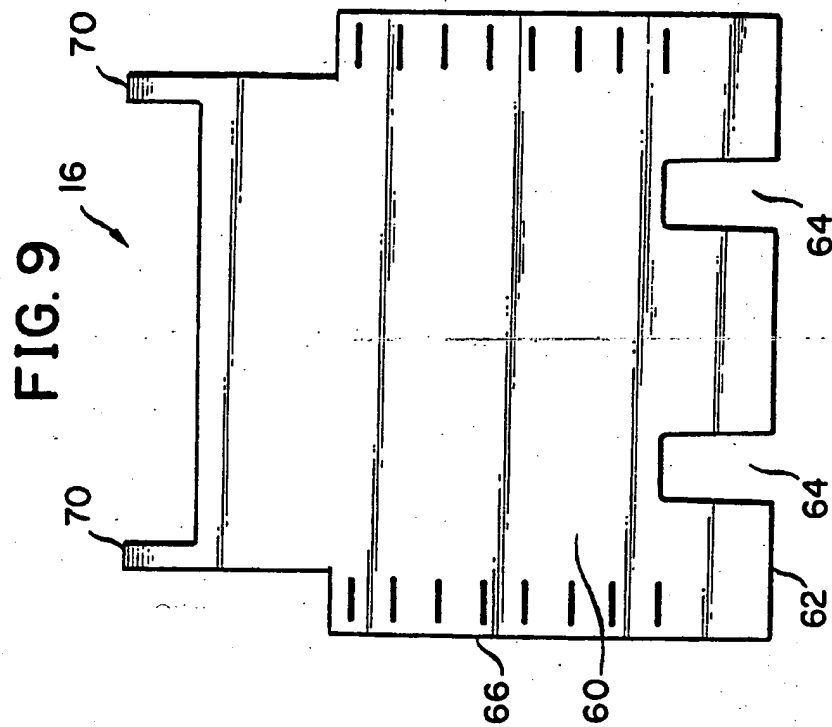


FIG. 6



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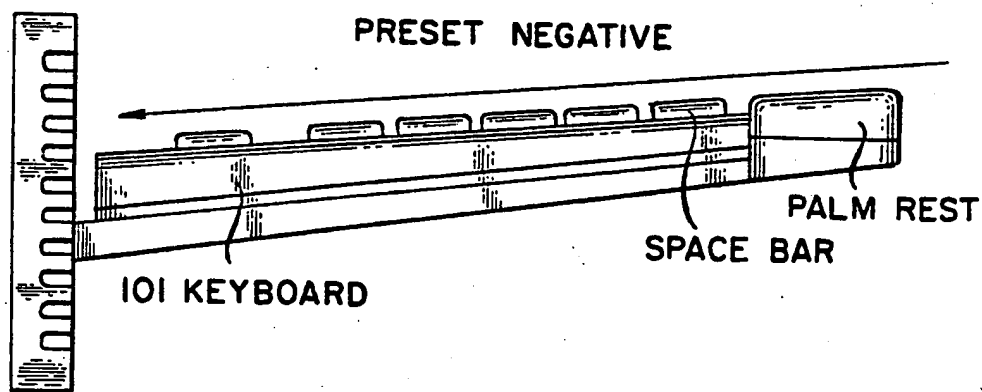
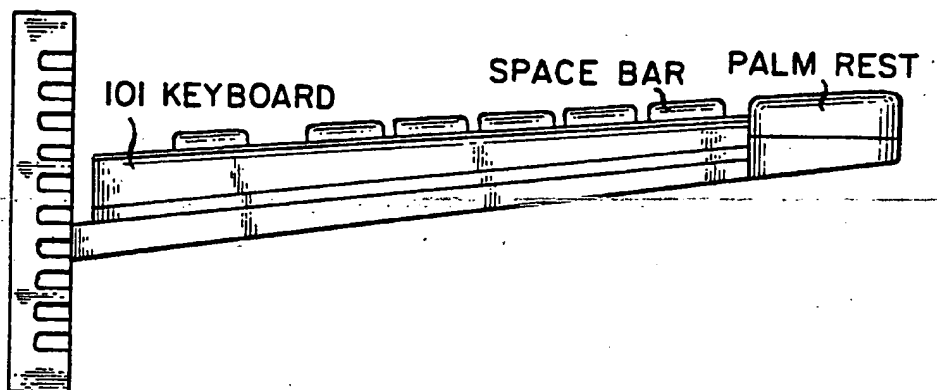
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FIG. 10

FRONT  
RATCHET  
HEIGHT  
ADJUSTMENT



# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US95/02012

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : A47G 29/00

US CL : 248/118, 918, 296

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 248/118, 918, 296, 118.1, 118.3, 118.5, 346, 345.1, 923, 922, 921, 286; 400/715, 718

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 5,048,784 (SCHWARTZ ET AL) 17 September 1991, figs. 5d and 6a.	1-6
A	US, A, 4,976,407 (SCHWARTZ ET AL) 11 December 1990, figs 2-4.	1-6
A	US, A, 5,211,367 (MUSCULUS) 18 May 1993, fig.7.	1-6

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

"	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance		
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Date of the actual completion of the international search

02 APRIL 1995

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